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Contract
CONTRACT FILE

Declass Review by NGA.

PAR 205, and

PAR 205-A

19 Jan 65

PROJECT TERMINATION REPORT

4X Chip Enlarger

19 January 1965

25X1

25X1

GROUP 1
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PROJECT TERMINATION REPORT

PAR 205, and
PAR 205-A

19 Jan 65

SUBJECT: 4X Chip Enlarger

TASK/PROBLEM

1. To design and fabricate a prototype enlarger to expose, with a minimum loss of information content, 4 x 5 inch film chips at a fixed 4X magnification from selected areas of high-resolution (up to 200 L/mm), black-and-white roll negatives. Each chip to have a two-line title across one end: the first line to be human readable; the second to repeat the first in machine readable characters.

DISCUSSION

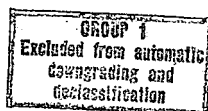
2. As a result of the conferences on Contract held at the customer's plant in June and July 1963, a need was recognized for new apparatus to provide high-quality prints from selected small areas of roll negatives. Two methods were suggested to achieve the desired high-quality selected area duplication and verbal authorization was given by the customer in September 1963 for minor project effort for "Preliminary engineering to establish concept and a design specification" for each method. PAR 204 was established for "HQ Contact Printer for selected areas". A companion project, PAR 205, was established for "Precision Enlarger, 4X".

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3. A preliminary specification 469-103, was written for the 4X Precision Enlarger based upon an f/3.0, 3.6X lens design available from a project on another contract, and based upon our experience with the 10-20-40X Precision Enlarger.

4. During the 3, 4 February 1964 conference on projects, the contractor was requested to revise the aims of the project to pro-

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PAR 205, and

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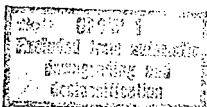
vide 4 x 5 inch "chip" prints with a human/machine readable title block. Considerable design study effort was made to explore means to generate the title block and expose it on the chip. In late April, a new proposal was submitted on the project.

CONCLUSION

5. The effort on this project produced the two proposals described above and provided a portion of the preliminary design study of the negative transport system now being fabricated for the breadboard enlarger system on PAR 202, Briefing Print Enlarger and PAR 224, 3X - 15X Fluid Gate Enlarger.

RECOMMENDATION

6. There is a good possibility that the high performance f/3.0, 3.6X lens mentioned in the proposals could be adapted as an interchangeable lens on the PAR 202, Briefing Print Enlarger or the PAR 224, 3 - 15X F. G. Enlarger. In this installation, it could provide a higher definition but smaller size (about an 8-inch diameter) print at 4X than that obtained with the lens designed for a 70mm square negative section in PAR 224. With this lens, the high-quality reprint enlargement capability visualized in the "Precision Enlarger, 4X" could probably be provided.



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Attachment #3

Misc - 56
21 Nov 64

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SUBJECT: Contract [] Progress Review Meeting, 18 Nov 64 -
PAR 205, Precision 4X Enlarger

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VISITORS: []

CONTRACTOR PERSONNEL: []

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1. Notice of deferment of this project was given in August 64. We took the occasion of the Progress Review Conference to verbally summarize our activity.

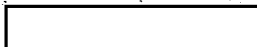
2. It is desirable for the contractor to provide a Project Deferment Report.

ACTION ITEM

3. The contractor will supply an estimate of total cost including a Project Deferment Report.

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MONTHLY REPORT



PAR 205

2 Oct 64

SUBJECT: 4X Chip Enlarger

TASK/PROBLEM

1. To design and fabricate a prototype enlarger to expose, with a minimum loss of information, 4- x 5-inch film chips at a fixed 4X magnification from selected areas of high-resolution (up to 200 lines/mm) black-and-white roll negatives. Each chip to have a two-line title across one end: the first line to be human readable; the second to repeat the first in machine-readable characters.

DISCUSSION

2. In accordance with customer's directive, message 2775, 18 August 64, effort on PAR 205 was terminated.
3. Effort up to 18 August 64 was directed toward preliminary investigation and preparation of revised technical objectives.

PLANNED ACTIVITIES

4. A report, 4X Chip Enlarger, PAR 205, documenting effort expended up to 18 August 64 will be published in November 64.
5. Authorization of actual expenditures up to 18 August 64 and estimated cost of report preparation will be requested in the near future.

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MONTHLY REPORT



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PAR 205

10 July 1964

SUBJECT: 4X Chip Enlarger

TASK/PROBLEM

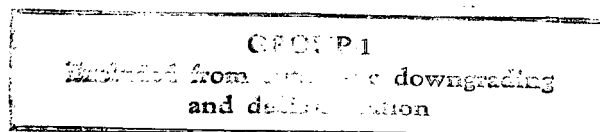
1. To design and fabricate a prototype enlarger to expose, with a minimum loss of information, 4 x 5 inch film chips at a fixed 4X magnification from selected areas of high-resolution (up to 200 lines/mm) black-and-white roll negatives. Each chip to have a two-line title across one end: the first line to be human readable; the second to repeat the first in machine-readable characters.

DISCUSSION

2. No Activity (See Paragraph 3).

PLANNED ACTIVITY

3. We are now awaiting comment upon or approval of the revised objectives as submitted.



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PAR 205

1 June 64

SUBJECT: 4X Chip Enlarger

TASK/PROBLEM

1. To design and fabricate a prototype enlarger to expose, with a minimum loss of information, 4 x 5 inch film chips at a fixed 4X magnification from selected areas of high-resolution (up to 200 lines/mm) black-and-white roll negatives. Each chip to have a two-line title across one end: The first line to be human readable; the second to repeat the first in machine-readable characters.

DISCUSSION

2. Revised proposal was submitted 27 April 64 based upon the contractor's study of the revision requested by the customer at the 3 and 4 February program review conference.

PLANNED ACTIVITY

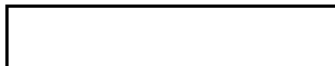
3. Awaiting action by the customer on the revised proposal.

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MONTHLY REPORT



PAR 205

1 May 64

SUBJECT: 4X Chip Enlarger

TASK/PROBLEM

1. To design and fabricate a prototype enlarger to expose, with a minimum loss of information, 4 x 5 inch film chips at a fixed 4X magnification from selected areas of high-resolution (up to 200 lines/mm) black-and white roll negatives. Each chip to have a two-line title across one end: the first line to be human readable; the second to repeat the first in machine-readable characters.

DISCUSSION

2. A preliminary copy of the revised technical objectives was delivered to the customer on 15 April 64 and a final copy was delivered on 27 April 64.

PLANNED ACTIVITY

4. We are now awaiting comment upon or approval of the revised objectives as submitted.

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FAR 205-A

Rec'd 27 apr 67

LX CHIP ENLARGER

10 April 1964

PROJECT AUTHORIZATION REQUEST

PAR 205-A

10 Apr 64

SUBJECT: 4X Chip Enlarger

TASK/PROBLEM

1. To design and fabricate a prototype enlarger to expose, with a minimum loss of information content, 4 x 5 inch film chips at a fixed 4X magnification from selected areas of high-resolution (up to 200 L/mm), black-and-white roll negatives. Each chip to have a two-line title across one end: the first line to be human readable; the second to repeat the first in machine readable characters.

PROPOSAL

2. It is proposed to conduct design studies to explore problems associated with critical components of the 4X Chip Enlarger and establish the over-all design concept. This phase of effort to be followed by design and fabrication of a prototype enlarger. The following areas will be explored during the design study phase.

a. Objective Lens and Condenser Lens Design:

(1) A computed lens design for 3.6X magnification with f/2.8 relative aperture is available from another contract with the U. S. Government. Theoretical analysis of the expected performance of this lens indicates it has the necessary high optical quality for the subject enlarger. It is planned to modify this lens design to provide the desired 4X magnification and to alter its field flattener to place a flat surface in contact with the negative as required for the fluid gate operation.

(2) A condenser lens to cover the required field size and to fill the 2.71-inch diameter aperture of this lens from existing lamps must be designed. To insure maximum optical capability, condenser design study will be accomplished as part of the lens design study program.

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10 Apr 64

(3) The proposed lens is corrected for a spectrum band 700A wide centered about 5460A. Orthochromatic print stock is required, such as Kodak SO-242. *5110 Å to 5810 Å, ±350 Å or ±35 Å? see #5 d*

b. Negative Handling:

(1) A means must be provided to quickly present the selected negative area to be printed to the printing gate from numeric specification of the frame number and X-Y coordinates. It is proposed that the successful Motorized Rewind System be adapted to this requirement. Modifications to be considered are:

(a) Add a film driven metering roll and indicating mechanism to measure the along-film coordinate.

(b) Add an adjustable indicating mechanism to the metering roll to count and indicate frame numbers as the film is wound at high speed.

(c) Provide a means to traverse the film transport in the across-film direction for viewing the film over an illuminator and then position any point across the film width at the optical axis of the projection system.

(2) During exposure of the print, the negative will be clamped between flat glass surfaces. A small quantity of index matching fluid will be injected into the gate on each side of the film just before the glass is pressed upon the film. This arrangement provides precise focus control, masking of light scratches, and flushing away of dust particles from the film and glass surfaces. Removal of the fluid from the negative surfaces will be done by an air stream directed against the film after the gate is opened and as the film is withdrawn to its position over the illuminator.

(3) Consideration will be given to the use of "Freon 113" as the immersion fluid. Experience with this fluid on another project indicates it has less effect on heat transfer film titles and can be removed from the film surface easier than tetrachloroethylene. The index match between this fluid ($n = 1.36$) and the gelatin ($n = 1.52$)

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of the films appears to be good enough to mask the nominal fine defects found on well-cared-for negatives.

c. The Output Materials:

(1) The chip will be a 4 x 5 inch print in any one of the three formats shown in Figure 1. A complete chip will be produced by a double exposure process in which one exposure produces the image from the selected negative area and the second produces the "format" pattern including:

(a) A fiducial mark at the center of each side of the image area to indicate the location in the image of the specified X-Y coordinates.

(b) The security code in two locations.

(c) A two-line title across one end of the chip. Each line of the title will contain about 43 characters. The first line to be in human readable characters; the second line to be a duplicate of the first, except presentation will be in machine readable code.

(d) Edges of the chip will be alignable in any orientation with the negative. The relative orientation to be established with ± 1 degree accuracy and recorded as part of the title.

(2) Study will give consideration to a system in which the chip format pattern, with trim guide marks added, will be exposed through the base of the print stock by optical projection in the same location at which the photo image is exposed from the emulsion side. Raw stock will be 9 1/2- inch wide film, maintained in a given orientation to the negative. A means will be provided to orient the titling format pattern as required relative to the masked chip image from the negative. A rotatable mask, coupled to the titling format image rotation system, will restrict the area of the photograph exposed during the titling exposure operation.

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10 Apr 64

(3) A convenient means will be devised to produce the the chip title. Present plans are to employ a system in which; the title is printed and punched on a standard 80 column data handling sytem punched card (or Title Card) then the punched title card is inserted into a Title Generator on the printer which will expose all or a selected part of the data punched in the card. It then seems feasible to convert the punched data to the chip title by using the punched holes as selecting apertures over a photo plate containing the desired human legible and machine readable characters.

*(4) Commercially available apparatus ranging from, a relatively simple keyboard operated card punch, or a system coupled to computer, can be used to generate the Title Cards. With such a system, the accuracy of the title can be checked before the chip print is exposed.

d. Enlarger Arrangement:

(1) The proposed objective lens design has a narrow field coverage at high image quality arising from the proposed large relative aperture, thus the over-all length of the optical path is expected to be 40 to 48 inches. The addition of the optical chip format generator and the lamp and condenser system will extend this length still more. The design study will consider a variety of folded optical paths to provide convenient operation and compact construction before a final configuration is established.

(2) A variety of techniques will be considered for previewing the image to be printed which may permit complete enclosure of the printing beam and consequently daylight operation of the instrument.

* This system of generation of the format and the physical production of the chip appears to be applicable to the Contact Chip Printer (PAR 204) also.

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e. Exposure Monitoring and Control: Since the magnification and lens aperture are fixed, consideration will be given to reading the negative density at the preview station to predict the required exposure. The possibility of reading integrated transmittance with subject classification will be explored. Also to be considered is the possibility of automatically exposing a number of prints in an exposure series ranging above and below the predicted nominal to give the photo interpreter a choice of print density level for optimum viewing and for density matching of stereo pairs.

f. Color Operation: Since exposure of color materials on the proposed enlarger would require a different lens design and would greatly complicate the design, it is recommended that modification for color printing be undertaken as a separate project at a later date.

g. Vibration Control: Through previous experience, good freedom from vibration effects has been achieved by building the optical unit as a single rigid system which in turn is isolated from the remainder of the machine and the building by very soft vibration isolation mounts. The design study will investigate rigidity and the mounting of the critical assemblies to the main structure in a manner to insure vibration-free photography.

h. Accessory Equipment:

(1) Equipment will be designed to accomplish chip cutting as a two-step process. The first step will be a rough square-cut across the print roll to separate each chip image. The second step will be to cut out the 4" x 5" chip with a punch and die after manual-visual positioning.

(2) Chip die will be designed to handle Estar and/ or acetate materials. Present experience indicates punch and die life when used with Estar is only about 25% of the normal life expectancy when used with acetate base materials. Proper preventive maintenance (sharpening) of the punch and die set should insure quality chip forming with a good life expectancy of the cutter.

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(3) It is proposed to make the chip cut-out equipment safe and rugged but as simple as possible. After experience is gained in the use of the printer and the chip cutting equipment, a better judgement can be made as to the desirable level of automation in chip cutting, and additional equipment developed as required and/or directed.

3. Special consideration will be given to:

- a. Maximum image quality.
- b. Reliability.
- c. Maintainability.

4. Since special emphasis must be placed on the three (3) items listed in para 3 above, the requirements listed below have been reviewed and will be incorporated in the design only to the degree indicated.

a. Accept two (2) rolls of negative film: To reduce complexity and maintain quality, enlarger will be designed to accept only a single roll of negative film.

b. Automatic threading: Automatic thread-up of the enlarger would increase complexity, reduce reliability, and tend to endanger original thin base negatives. Thread-up will be as simple as possible without full automatic threading.

c. Punch card data input is suggested rather than an external keyboard or punched tape (see para ~~3, (1)~~ above).

2, c, (4)

d. Adjustable X-Y measurement (rubber meter stick): A practical solution that will keep complexity at a minimum and insure quality is not known at this time (see para 2, b, (1)).

e. Automatic Exposure Control: The proposed system for exposure control is not fully automatic in that it includes operator judgement of the spot to be read or of the subject classification (see para 2, e.)

5. Present Design Objectives for the Chip Enlarger are:

- a. Magnification: 4X only.

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b. Print output: 4 x 5 film chip with variable formats (3 only, See Fig. 1) title, security code label, and fiducial marks. The chip format may have any chosen orientation relative to the original negative.

c. Negative Handling: Provide for roll film 70mm to 9 1/2-inch wide and lengths up to 500 feet, on MIL Standard spools.

d. Printing Capability: The objective lens to be designed for maximum optical quality. Color correction of the lens will be for a spectral band at $5460 \pm 35\text{\AA}$ (green light) and the print stock will be "ortho" sensitized, such as SO-242. $\pm 35\text{\AA}$ or $\pm 350\text{\AA}$? see 9 2 a (3)

e. Film Gate: A fluid injection negative gate with air stream fluid removal will be employed. In addition, a means will be provided to quickly present to the printing gate from frame and X-Y coordinate identification, the negative area to be printed. It will be possible to place any point within the negative area at the optical axis of the projection system.

f. Provide an exposure monitoring photometer.

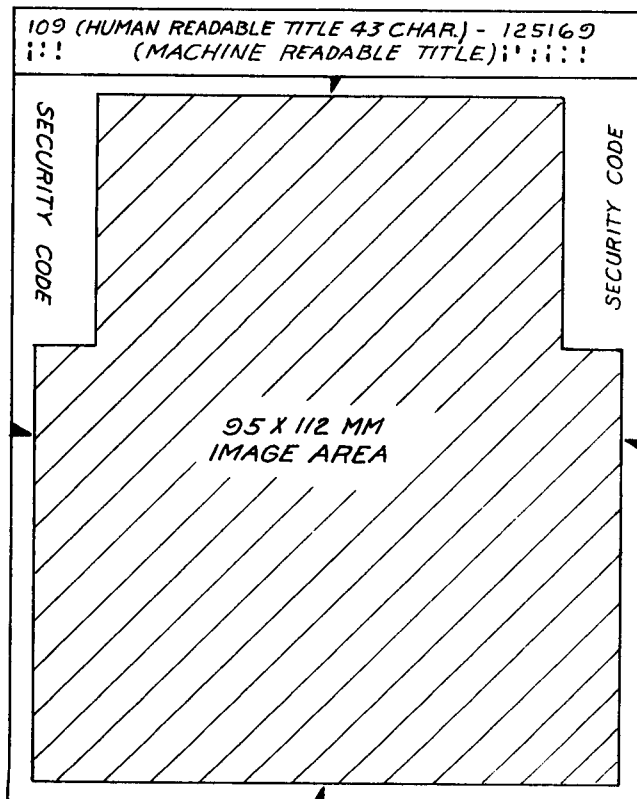
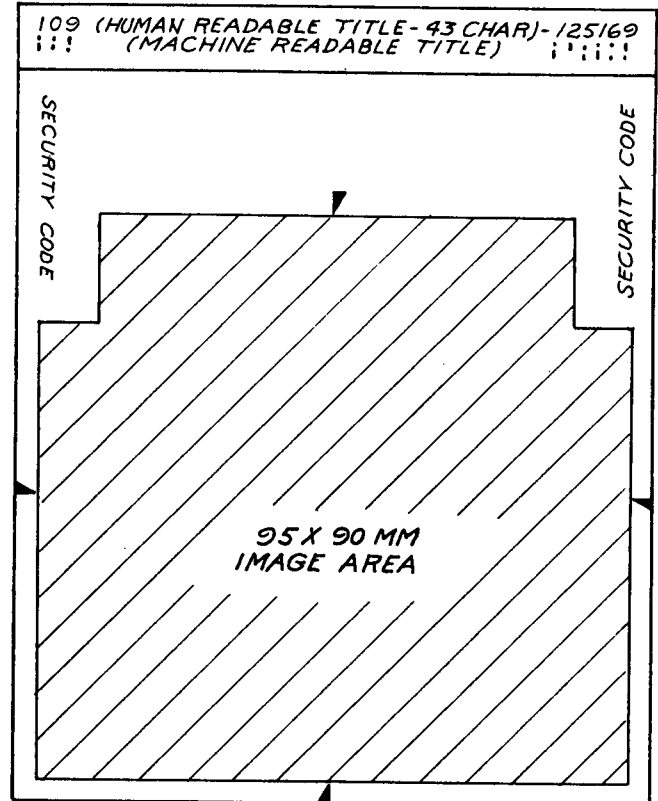
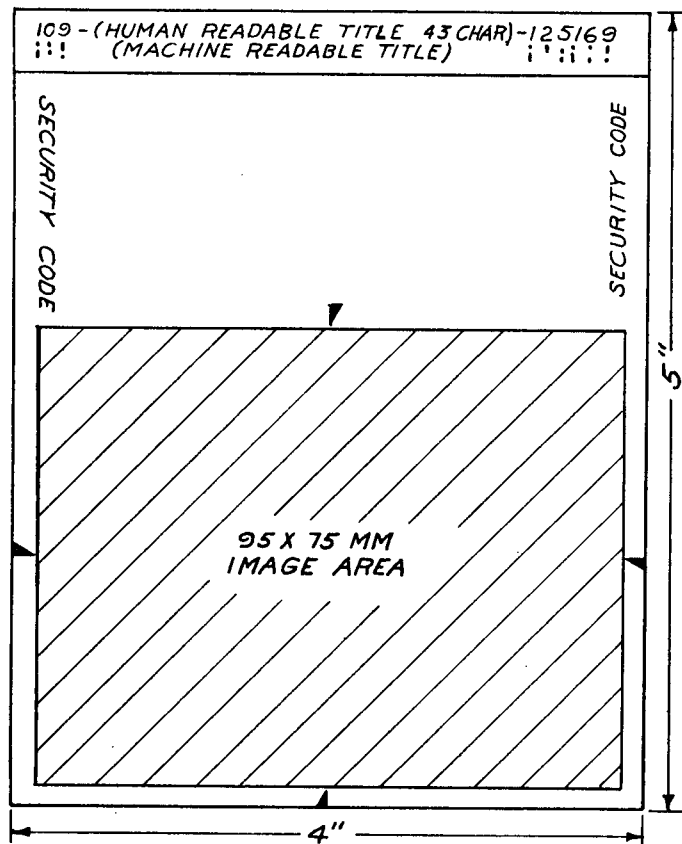
g. Exterior design: To be smooth to facilitate cleaning as required for proper housekeeping in film handling areas.

h. Insure high efficiency, simple construction and low maintenance requirements.

PROGRAM OBJECTIVE

6. To design, fabricate, test and deliver one 4X chip enlarger. It is proposed the effort be scheduled in two phases:

a. Phase I - Provide preliminary design, final specifications and optical designs. Reaching these goals will require construction of breadboards and/or models for testing of the following subassembly designs:



PROPOSED
4"x5" CHIP FORMAT

FIGURE 1

PAR 205-A

10 Apr 64

- (1) Objective lens and condenser system.
- (**)(2) Titling system including format rotation capability.
- (3) Print stock roll holder.
- (**)(4) Integrated transmittance exposure photometer and exposure control system.
- (***)(5) Negative transport system with X-Y coordinate measuring and frame counting.

b. Phase II - Complete the design, fabricate and accomplish in-house testing of the prototype 4X Chip Enlarger.

7. Upon completion of Phase II, the instrument will be crated and prepared for shipment pending special instructions from the customer.

SCHEDULE

8. Tentative schedule covering Phase I is shown in Fig. 2. Although the tentative schedule shows approximately fourteen months for completion of Phase II, detail scheduling can only be furnished on or near completion of Phase I and will be furnished at that time for consideration by the customer.

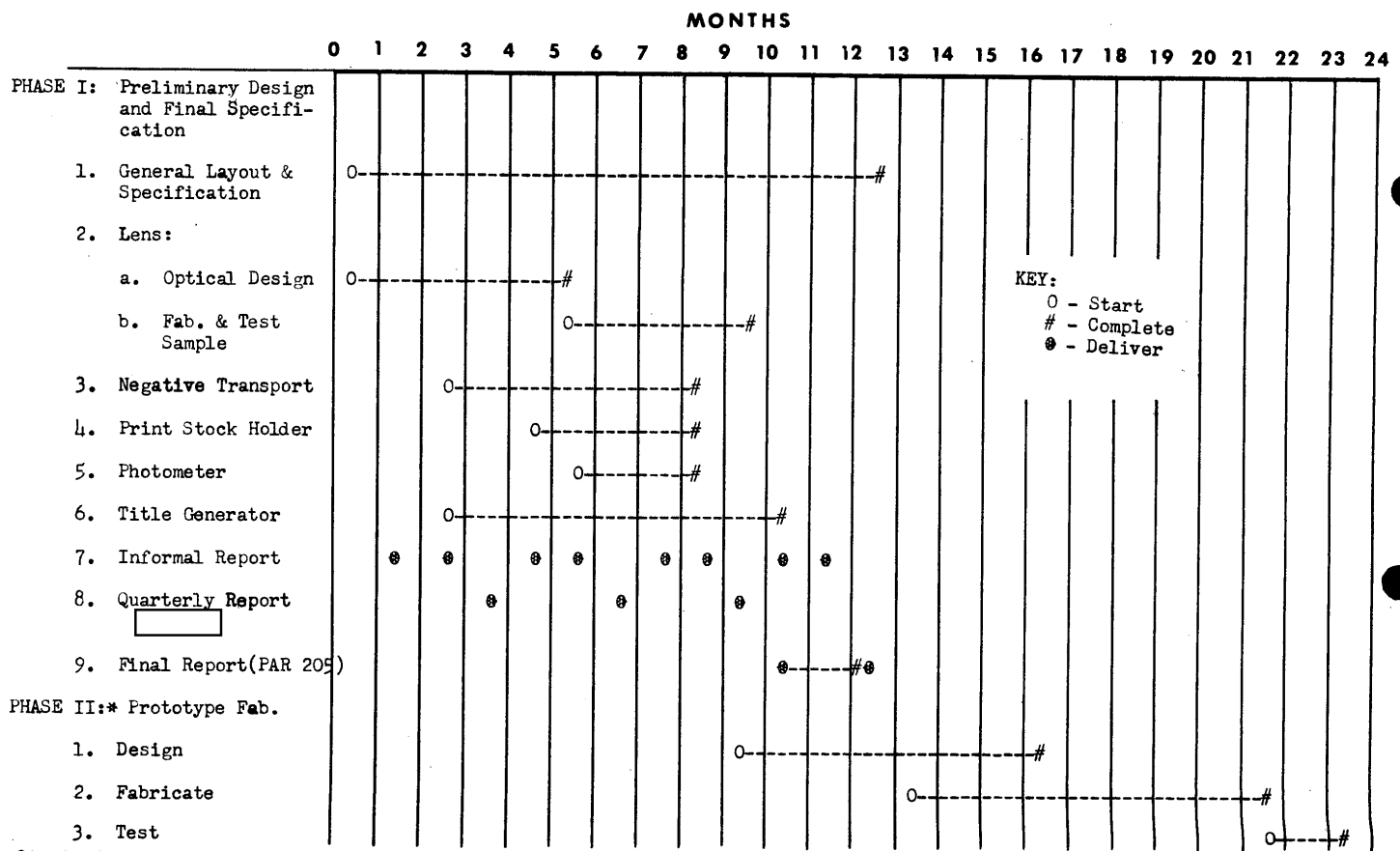
** Test and evaluation of item (2) and (4), para 6a can be accomplished jointly with similar efforts on PAR 204-A, Contact Chip Printer.

*** Test and evaluation of item (5), para 6a will have many steps in common with a similar test on PAR 224, 3-15X Fluid Gate Enlarger; PAR 202-A, Briefing Print Enlarger; and PAR 204, Contact Chip Printer.

TENTATIVE SCHEDULE

LX CHIP ENLARGER

PAR 205-A
10 Apr 64



*Start of Phase II should be at end or near end of Phase I. Detailed schedule will be furnished at that time on request.
Fig. 2